

REMARKS

Claims 1 - 20 remain active in this application. Claims 11 - 20 have been withdrawn from consideration as being non-elected in response to requirements for restriction and election of species; election in response to the requirement for restriction having been made without traverse and the election in response to the requirement for election of species having been made with traverse. The specification has been reviewed and editorial revisions made where seen to be appropriate. Correction of the termination of a lead line has been proposed in Figures 1 - 6 for which the Examiner's approval has been requested. Claim 1 has been amended. Support for the amendments of the claims is found throughout the application, particularly in Figures 3 and 6 and the description thereof on pages 11 - 12. No new matter has been introduced into the application. The indication of allowability of the subject matter of claims 8 and 9 is noted with appreciation.

The Examiner has maintained the requirement for election of species. However, the traverse of that requirement is maintained for the reasons of record, especially in regard to the species of Figures 1 - 3 (the first embodiment) and Figures 4 - 6 (the second embodiment) which both feature a barrier above the alloy region although the alloy region is configured differently between these species. At least claim 1 has been indicated by the Examiner to be generic and is respectfully submitted to remain generic to all three embodiments of the invention as amended above. Moreover, claims which are directed to the elected species have been allowed and therefore the search for the elected species clearly comprehended a search for at least the species of the first embodiment, Figures 1 - 3, as well, in order to search the subject matter of

the generic claim(s). Therefore, on the record, there is clearly no serious burden of examination at least in regard to at least the first and second embodiments of the invention and the requirement for election of species should be withdrawn at least in regard to those two embodiments. Accordingly, reconsideration and withdrawal of the requirement for election of species is respectfully requested.

The Examiner has objected to the drawings in regard to reference numerals. This objection is respectfully traversed, particularly as being moot in view of the proposed change in Figures 1 - 6 and the above amendments to the specification.

Specifically, the correction of the termination of a lead line corresponding to reference numeral 120 for the illustrated trench in which conductor 130 is formed has been proposed, consistent with the specification and the informal drawings originally filed. Reference numeral 415 does, in fact, appear in paragraph [0033] of the specification and reference numeral 450 has been added thereto. It is also respectfully submitted that the Examiner is incorrect in regard to reference numerals 410 and 420, applied to the liner and barrier, respectively - see paragraph [0032]) since the respective lead lines terminate at different structures. Accordingly, reconsideration and withdrawal of this ground of rejection are respectfully requested.

Claims 1 - 4, 6 and 7 have been rejected under 35 U.S.C. §102 as being anticipated by Besser et al. and claim 5 has been rejected under 35 U.S.C. §103 as being unpatentable over Besser et al. in view of Aller. These grounds of rejection are respectfully traversed as being moot in view of the amendments made above.

Initially, it is noted in regard to the rejection of claim 5 that the stated ground of rejection is *prima facie* in error since the patent number stated for Aller

corresponds to a patent to Wang et al. as listed on the PTO-892 attached to the current office action and no patent to Aller appears to have been made of record. Therefore, clarification of the grounds of rejection of claim 5 is respectfully requested.

In regard to Besser et al., applied in both grounds of rejection, while Besser et al. is directed to formation of a region 50 which is a solid solution of an alloying element in a conductor below a via and the formation of a barrier 46 above that region to reduce electromigration. The alloying material is supplied by implantation. In sharp contrast therewith, the invention is directed to simultaneously addressing the problems of metal adhesion and electromigration consistent with minimization and stabilization of electrical resistance and does so by supplying an alloying material by deposition and/or diffusion of a predetermined quantity of alloying material. As pointed out in the Background section of the present application, alloying materials which may improve adhesion generally tend to degrade the conductivity of copper while other materials exhibiting that effect to a lesser degree present additional problems of gettering of contaminants which also increase bulk resistance or cause additional problems. Further, electrical properties of alloys may change radically with concentration of alloying material.

By supplying the alloying material by deposition and/or diffusion from a predetermined quantity of alloying material, the alloy material concentration is always such as provides graded mechanical properties and usually fully reacted, even during the process of the formation of the alloy, and thus highly stable in regard to both alloy concentration and electrical characteristics and can be of minimal thickness, as discussed at paragraph [0018] and elsewhere in the present application since diffusion of alloying

material is limited to one diffusion length from the reaction front where a stoichiometric alloy is formed in accordance with the invention.

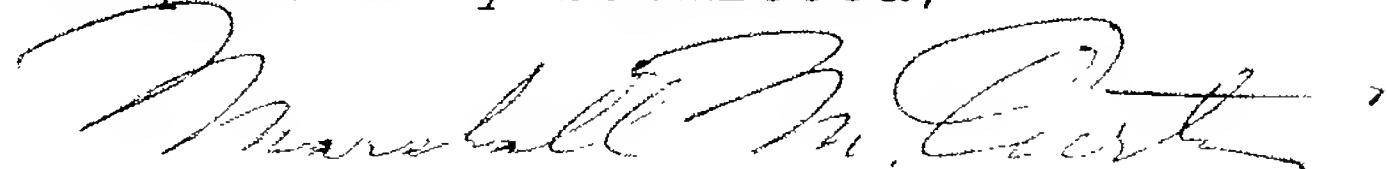
Such meritorious effects are not available or the possibility of their production even remotely suggested in Besser et al. and certainly would not necessarily result from implantation and later heat treatment to form an alloy and thus cannot be asserted to be inherent. On the contrary, as is well-understood in the art, implantation inherently provides a distribution of the implanted material which varies with depth within the region implanted which is necessarily entirely within the implanted material body and necessarily much different from the distribution of alloying material as diffused into a region from a surface where the alloying material is deposited. It does not appear that Besser et al. provides any teaching or suggestion of any particular distribution of alloying material (especially since no particular implantation energy appears to be mentioned) and discloses a wide range of implanted material concentration (column 5, line 45) which is necessarily *within* the conductor when the alloying is performed and which is explicitly noted to be non-critical as to quantity. Thus, Besser et al. does not recognize the further unexpected benefits which may be derived from forming an alloy in the manner of the invention or even suggest the possibility of developing the qualities and features claimed. While a recitation of deposition and diffusion would not be appropriate to the device claims 1 - 10, there is no teaching or suggestion in Besser et al. of an alloy region having the features and properties now recited. The Examiner has not asserted that Wang et al. or Aller or any other reference mitigates this clear deficiency of Besser et al. Therefore, it is respectfully submitted that the grounds of rejection asserted by the Examiner are

clearly untenable in regard to the claims as now amended. Accordingly, reconsideration and withdrawal of the grounds of rejection of record are respectfully requested.

Since all rejections, objections and requirements contained in the outstanding official action have been fully answered and shown to be in error and/or inapplicable to the present claims, it is respectfully submitted that reconsideration is now in order under the provisions of 37 C.F.R. §1.111(b) and such reconsideration is respectfully requested. Upon reconsideration, it is also respectfully submitted that this application is in condition for allowance and such action is therefore respectfully requested.

If an extension of time is required for this response to be considered as being timely filed, a conditional petition is hereby made for such extension of time. Please charge any deficiencies in fees and credit any overpayment of fees to Deposit Account No. 09-0458 of International Business Machines Corporation (E. Fishkill).

Respectfully submitted,



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